REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification, which includes the Abstract, in order to conform the specification to the requirements of United States Patent Practice. No new matter is added thereby. Attached hereto is a Substitute Specification including a marked-up version of the changes made thereto via by the present amendment.

In addition, the present amendment cancels original claims 1-3 in favor of new claims 4-6. Claims 4-6 have been presented solely because the revisions by red-lining and underlining which would have been necessary in claims 1-3 in order to present those claims in accordance with preferred United States Patent Practice would have been too extensive, and thus would have been too burdensome. The present amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-3 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-3.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

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Dated: January 24, 2005

Marked-Up Version of Substitute Specification

~~Description~~

~~Method for heat dissipation in mobile radio devices, and a corresponding mobile radio device~~

SPECIFICATION

TITLE OF THE INVENTION

METHOD FOR HEAT DISSIPATION IN MOBILE RADIO DEVICES, AND A CORRESPONDING MOBILE RADIO DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a method for heat dissipation in mobile radio devices, and to a corresponding mobile radio device. An operating range with an environmental temperature generally of +55°C is specified in mobile telecommunications terminals and in mobile radio devices, such as mobile telephones, PDAs and laptops. These mobile radio devices are constructed like a shell for the electronic components, wherein ~~and~~ the temperature rises from shell to shell towards the components. The maximum temperature is functionally limited. The temperature close to the individual components in this case may be an environmental temperature of 82°C, while the temperature of the component itself may be up to 100°C. The electronic components convert the majority of the energy/power supplied to them to heat, which heats not only the component itself but also its immediate surrounding area. The power that is converted to heat is, accordingly, ~~accordingly~~ a power loss.

In new, future mobile radio devices with the introduction of data services via~~by means of~~ GPRS with a so-called Class 10, the power with two transmission time slots is doubled, which also results in~~means that~~ the power loss produced by the electronic components ~~is~~ also being virtually doubled. The subdivision into "classes" relates to details of the configuration of the transmission and reception time slots. In Class 10, two transmission time slots are possible, wherein~~which means that~~ not only the transmission power but also the power loss is doubled.

In even higher GPRS classes, such as GPRS Class 12, the power loss is up to a multiple of this. This results in a threat of the components being overheated after a certain operating time.

The following table provides a rough overview of the GPRS classes:

Multislot Class	Transmission slots	Reception slots	Number of slots (usable)
1	1	1	2
. . .			
8	1	4	5
. . .			
10	2	4	5
. . .			
12	4	4	5

This type of problem has not occurred in the past in the field of mobile telecommunications since this technology is only now being introduced. In the past, mobile radio devices have been implemented and operated on the basis of GPRS Class 8.

In other electronic devices, such as desktop computers, heat sinks or fans have been mounted on the temperature-critical components. When fitting heat sinks, care must be taken to ensure that good thermal coupling is provided between the heat sink and the electrical component which is heated by the power loss. In order to exclude air, as a poor thermal conductor, spaces between the corresponding component and the heat sink are filled with thermally conductive sheets or thermally conductive pastes.

Furthermore,~~Furthermore~~ the distribution of the heat in electrical components can be influenced by a matched structure.

Thermally conductive sheets and thermally conductive pastes are admittedly better thermal conductors than air, but they are also not adequate to ensure satisfactory heat dissipation for electrical components.

Accordingly,~~One object of~~ the present invention seeks~~was thus~~ to provide a method which makes it possible to ensure good and satisfactory heat dissipation from electronic components in mobile radio devices, as well as~~. A further object of the present invention was to provide~~ a corresponding mobile radio device.

~~This object is achieved by a method according to the invention as claimed in claim 1, and by a mobile radio device according to the invention as claimed in claim 5. Further advantageous embodiments of the invention are specified in the corresponding dependent claims.~~

SUMMARY OF THE INVENTION

Accordingly,~~Claim 1 provides~~ a method is provided for heat dissipation in mobile radio devices having heat-emitting, electrical components, in which the heat-emitting components are brought into heat-dissipating contact with a metal foil.

In one preferred embodiment of the method according to the present invention, the metal foil is corrugated and/or is structured in the form of a honeycomb. The use of a metal foil which is corrugated and/or is structured in the form of a honeycomb minimizes the resistance for heat dissipation. The capability of the metal foil that is corrugated and/or is structured in the form of a honeycomb to deform results in~~means that~~ any intermediate spaces which occur being~~are~~ completely filled, thus ensuring optimum heat dissipation. The metal foil which is corrugated and/or in the form of a honeycomb can be arranged in an interlocking manner on the surfaces which can be brought into contact for heat dissipation.

In a further preferred embodiment of the method according to the present invention, the metal foil is brought into contact with a heat sink. The heat sink may, for example, be a metallic body which either has a large area for radiated emission and/or a large volume as a heat sink.

In another preferred embodiment of the present invention, the metal foil is itself used as a heat sink. The magnitude of the heat loss to be dissipated, in particular, determines whether the metal foil is itself adequate as a heat sink. The honeycomb and/or corrugated structure provided according to the present invention offers a very large heat-emitting surface area.

Furthermore, the present invention covers a mobile radio device having heat-emitting electrical components, in which the components are each in heat-dissipating contact with a metal foil.

The metal foil is preferably corrugated and/or has a honeycomb structure. The use of a metal foil which is corrugated or is structured in the form of a honeycomb enlarges the radiation-emitting surface area. The heat dissipation resistance is minimized, on the one hand, ~~on the one hand~~ by the use of a metallic foil as well as by its structure, which is corrugated or is in the form of a honeycomb.

Furthermore, in a further preferred embodiment of the mobile radio device according to the present invention, the metal foil is in heat-dissipating contact with a heat sink.

In another preferred embodiment of the mobile radio device according to the present invention, the metal foil itself acts as a heat sink. Its honeycomb and/or corrugated structure results in~~means that~~ it having~~has~~ a very large heat-emitting surface area.

Furthermore, the present invention covers the use of a metal foil which is corrugated and/or is structured in the form of a honeycomb for heat dissipation from heat-emitting electrical components in mobile radio devices.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

~~Further advantages will be explained in more detail with reference to the following figures, in which:~~

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows a schematic illustration of one implemented embodiment of the method according to the present invention.~~invention;~~

Figure 2 shows a schematic illustration of another implemented embodiment of the method according to the present invention.~~invention;~~

Figure 3 shows a schematic illustration of a further implemented embodiment of the method according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a printed circuit board 1 which is fitted on one side with components 2 which develop a large amount of heat. A heat sink 4 in the form of a cold plate is arranged on the other side of the printed circuit board 1 via~~by means of~~ suitable connecting elements 3 which, for example, may be screws or rivets. During the fitting of the heat sink 4, good thermal coupling between the heat sink and the electrical components 2 is a key~~the critical~~ factor ensuring that the components 2 are not excessively heated, which could ~~thus~~ possibly lead to destruction of the components 2. In order to avoid poor thermal conduction, a metal foil 5 or a metal paste is, according to the present invention, inserted in the space which occurs between the printed circuit board 1 and the heat sink 4.

Figure 2 shows another possible implementation of~~way to carry out~~ the method according to the present invention. Figure 2~~The figure~~ once again shows a printed circuit board 1 which is fitted with a component 2, that ~~that~~ produces heat losses, on one side. A shielding cover 6 is also provided above the component 2~~2,~~ for shielding. A heat sink 4 is arranged on the other side of the printed circuit board 1. This may be a heat sink, a battery or a chassis. According to the present invention, a metal foil 5, which is corrugated and/or structured in the form of a honeycomb, is arranged in the resultant spaces between the component 2 or the printed circuit board 1 and the shielding cover 6 or the heat sink 4. The capability of the metal foil 5, which is corrugated and/or structured in the form of a honeycomb, to deform allows very good contact for heat transfer. On the one hand, the metal foil 5 may provide only the junction to a heat sink 4, ~~as~~ in this case,~~case~~ in the space between the heat sink 4 and the printed circuit board 1. Furthermore, the metal foil 5 could itself act as a heat sink. This is because the use of a metal foil 5 with a corrugated or honeycomb structure considerably enlarges the radiation-emitting surface area.

Figure 3 shows a further possible implementation of~~way to implement~~ the method according to the present invention. In this case as well, Figure 3~~the figure~~ shows a printed circuit board 1 with a lossy component 2 arranged on one side of the printed circuit board 1. Furthermore, a plastic part 7 is arranged on the other

side of the printed circuit board 1. A metal foil 5 which is in the form of a honeycomb and/or is corrugated is provided between the plastic part 7 and the printed circuit board 1 and can be matched to the respective surfaces by virtue of its capability to be deformed well. By virtue of its structure, the metal foil 5 itself has a very large heat-emitting surface area, which represents an additional beneficial factor.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the present invention as set forth in the hereafter appended claims.

ABSTRACT OF THE DISCLOSURE

The present invention relates to a method for heat dissipation in mobile radio devices, with heat-radiating electrical components ~~(2)~~, whereby the heat-radiating components are brought into heat-dissipating contact with a metal film ~~(5)~~. The present invention further relates to a mobile radio device with heat-radiating electrical components ~~(2)~~, whereby each component is in effective heat-dissipating contact with a metal film.